OPENING AND CLOSING MECHANISM FOR ELECTRONIC DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an opening and closing mechanism for an electronic device, and more particularly to an opening and closing mechanism for a flip-type portable telephone including a pair of bodies which carry electric circuits, and are opened and closed with electric circuits connected.

2. Description of the Prior Art

FIG. **13** of the accompanying drawings is a perspective view of a portable telephone shown and described in Japanese Patent Laid-Open Publication No. Hei 6-152,491. The portable telephone comprises an upper body **101** and a lower body **102**, which are rotatably joined via a hinge **103** disposed at one end of each body. In other words, the lower body **102** is freely opened and closed with respect to the upper body **101** via the hinge **103**.

The upper body **101** houses a radio unit **104** as an electric circuit. Similarly, the lower body **102** houses a controller **105** as an electric circuit. The radio unit **104** and the controller **105** are connected by distribution cables **106** and **107**. These distribution cables **106** and **107** pass through the hinge **103** which is parallel to an opening and closing direction of the lower body **102**. Whenever the lower body **102** is opened or closed via the hinge **103**, both the distribution cables **106** and **107** are inevitably and repeatedly twisted or untwisted by a load applied thereto. These cables **106** and **107** are usually radio frequency (RF) coaxial cables including conductors and insulation coatings.

Unfortunately, the foregoing portable telephone incorporating the opening and closing mechanism is prone to the following problems. The distribution cables **106** and **107** for connecting the radio unit **104** and the controller **105** are arranged such that they may be repeatedly twisted and untwisted at the hinge **103** whenever the lower body **102** is opened and closed. Thus, the insulation coatings of the distribution cables **106** and **107** may become damaged, which will lead to eventual breaking of the distribution cables **106** and **107**. The broken distribution cables **106** and **107** will cause a poor electrical connection. Especially, whenever the lower body **102** is opened and closed through a large angle, the distribution cables **106** and **107** will be extensively and repeatedly twisted and untwisted. This will frequently result in poor electrical connections of the portable telephone.

SUMMARY OF THE INVENTION

The invention is intended to overcome the foregoing problems of the prior art.

A first object of the invention is to provide an opening and closing mechanism for an electronic device which can prevent a poor electrical connection at an opening and closing section.

A further object of the invention is to provide an opening and closing mechanism which can be manufactured at a reduced cost as well as accomplishing the foregoing object.

A still further object of the invention is to provide an opening and closing mechanism which can be efficiently assembled as well as having the foregoing advantages.

According to a first aspect of the invention, there is provided an opening and closing mechanism for an electronic device, comprising: a main body and a sub-body

respectively including electric circuits; a hinge unit for joining one end of each of the main body and the sub-body, the hinge unit including a shaft attached to the end of the sub-body, a cam having a central rotation axis coupled to the shaft and being capable of setting opening and closing angles of the sub-body, and an angle regulating leaf spring for maintaining the cam at a set angle; and a distribution cable for establishing an electrical connection between the electric circuit of the main body and the electric circuit of the sub-body, the distribution cable having intermediate portions wound around the shaft of the hinge unit. The sub-body is opened and closed at the end thereof with respect to the main body via the hinge unit serving as a turning center.

In this arrangement, the distribution cable is wound around the shaft of the hinge unit. Thus, the distribution cable is stretched when the sub-body is opened, while it is compressed when the sub-body is closed. In other words, the distribution cable is not twisted or untwisted whenever the sub-body is opened or closed. This is effective in preventing the distribution cable and insulation coatings thereof from being damaged and broken, and in protecting the distribution cable against poor connections. The more loosely and the more times the distribution cable is wound around the shaft, the less stress (i.e. tension and compression) will be applied to the distribution cable. This is also effective in protecting the distribution cable against breaking and poor electrical connection.

The distribution cable and the electric circuits of the main body and the sub-body are connected via a conductive and flexible cable.

The conductive and flexible cable can reduce the tension applied to the distribution cable applied by the opening of the sub-body, which is effective in preventing breaking and poor electrical connection of the distribution cable, and in enlarging opening and closing angles of the sub-body.

In accordance with a second aspect of the invention, there is provided an opening and closing mechanism for an electronic device, comprising: a main body and a sub-body respectively including electric circuits; a hinge unit for joining one end of each of the main body and the sub-body, the hinge unit including a shaft for opening and closing the sub-body at the end thereof with respect to the main body; and a distribution cable for establishing an electrical connection between the electric circuit of the main body and the electric circuit of the sub-body, the distribution cable having at least flexible intermediate portions wound around the shaft of the hinge unit. Thus, the sub-body is opened and closed at the end thereof with respect to the main body via the hinge unit serving as a turning center.

This arrangement is also effective in preventing the breaking of the distribution cable and poor electrical connections. The flexibility of the distribution cable at its intermediate portion wound around the shaft of the hinge unit can dispense with the cam for regulating the opening and closing angles of the sub-body and the angle regulating leaf spring. This simplifies the hinge unit, and the overall structure of the opening and closing mechanism. This further leads to a reduction of the manufacturing cost.

According to a third aspect of the invention, there is provided an opening and closing mechanism for an electronic device, comprising: a main body and a sub-body respectively including electric circuits; a hinge unit for joining one end of each of the main body and the sub-body, the hinge unit including a conductive shaft attached to the end of the sub-body, a cam having a central rotation axis coupled to the conductive shaft and being capable of setting